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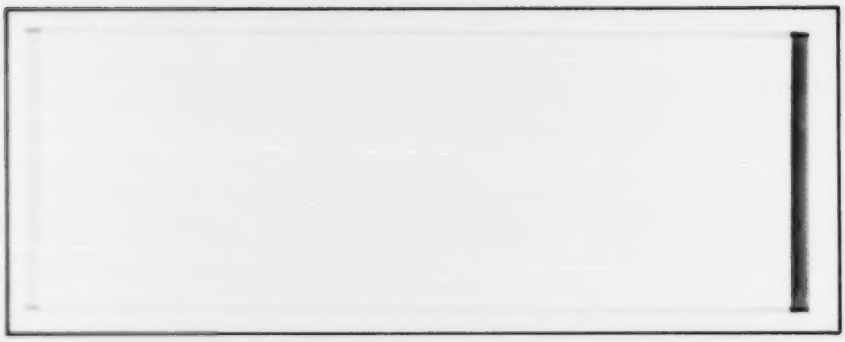

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EXPORTER COOPERATION IN THE WORLD GRAIN TRADE

(Working Paper 3/88)

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FORWARD

The health of Canada's agricultural sector, and especially the Prairie economy, is inextricably tied to export markets. The majority of grain produced on the Prairies is dependent on markets outside of North America. The viability of agricultural exports is currently threatened by a potpourri of inward looking policies that have resulted in serious international trade distortions and conflicts. A workable international mechanism to deal adequately with the issues involved does not exist at this time. Most nations, including Canada, are counting on the Uruguay Round of GATT Multilateral Trade Negotiations to provide a solution.

This particular research effort has two main purposes. The first objective is to provide Canadian trade negotiators with an indication of the supportive role analysts using quantitative models can play in the MTN. Agriculture Canada's models have the ability to respond to a wide range of policy and trade scenarios that will be discussed in the MTN. The second objective involves determining what impact a short-term, multilateral effort for grains will have on the world market. No research to date has been undertaken to assess the impact a cooperative grain program would have on grain exporting nations and if Canada, and other countries, would benefit from such a scheme. This report attempts to provide some of the information required to fill this void.

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SUMMARY

Background

The fundamental cause of low world grain prices is the domestic sector support provided by most major grain importers and exporters. Supply has exceed demand for several years resulting in the accumulation of burdensome stocks in the US and to a lesser extend in the EC. Current low prices reflect this market imbalance and were triggered by the unilateral change in US policy to no longer artificially prop up world prices as it had during the first half of the 1980's, to eliminate surplus stocks, and to recapture lost world market share. Export subsidies are a major weapon in the US endeavour.

Cooperative Approach to Supply Adjustment

An analysis was carried out to see if a combined land set-aside effort by Canada, the US, the EC, Australia and Argentina could reduce the surplus stocks in an effective manner.

In each country 10 percent of grain land is assumed to be taken out of production and US export subsidies eliminated. Over a five year period surplus stocks are released and land is returned to production so as to achieve a long run equilibrium US farm price for wheat of $ 4.00/bu and corn $ 2.80/bu (in Canadian dollars), roughly in line with prices received in the 1984-85 period. All other policies in all countries are left in place.

The world and US impacts are determined with the FAPRI model (CARD, Iowa State University) and Canadian impacts are determined using three quantitative models at Agriculture Canada, with the current medium term forecast used as the comparative baseline. An important objective is to assess the ability of the Canadian models to address a single trade policy issue in an integrated fashion.

Results

Analysis indicates that a short term land set-aside program among the five major grain exporters (US, Canada, the EC, Australia and Argentina) will help to remove the burden of excess stocks and improve prices. The following are the major impacts on world markets and production:

1. The 10 percent diversion is sufficient to bring within 5 years stocks down to commercial levels. Commercial means 1 billion bushels of wheat and 2.5 billion bushels of corn in the US.
2. All diverted wheat and one-third of the coarse grain land is brought back into production within 5 years.
3. The target equilibrium prices are achieved, which represents an increase in US wheat prices of 30 percent over current forecasts and corn prices up 15 to 20 percent.
4. World imports decline by only 2 to 3 percent.
5. US market share increases in the initial years as surplus US stocks are moved through the market.

6. US farm income is almost unaffected, but improved market returns reduce government costs by some $US 3 billion a year.
7. In terms of export revenues Australia benefits and Argentina remains about the same. Insufficient information is available on the EC to make an assessment.

The impact on Canadian markets and production is more pronounced because of the added impact of eliminating the US export subsidies. The major findings for Canada are:

1. By the forth year wheat and barley prices are up 40 to 50 percent.
2. Realized Net Farm Income is up by 60 percent.
3. Livestock production is negatively affected by higher grain prices, with beef production down 3 percent and hog production down 7 percent.
4. Over the five year period the government realizes a savings of $1 billion in stabilization payments (excluding any extension of the SCGP past 1986/87).
5. By the fifth year wheat exports are higher than the baseline, but coarse grain exports are down by 50 percent.
6. A paid diversion could cost $300-400 million annually.
7. There is a small positive impact on the Canadian economy. Industrial output for the five years is up by $2.5 billion, GDP increases by $1.9 billion and 13,000 addition jobs are created.

Conclusion

From this preliminary analysis Canada appears to benefit from participating, as does the US. Three general conclusions are:

1) that a multilateral action can correct the current market imbalance;
2) that action is relatively small in magnitude; and
3) that only modest adjustments to current national programs are required.

The conclusion that an ad hoc, short term program may be effective in bringing world grain markets into balance for a period of time should not be taken as a suggestion that any less emphasis is needed in the MTN's on addressing the root causes of the imbalance.

The objective of international agricultural policy reform is to set in train forces and incentives that would move the agricultural economy in the direction of a restored equilibrium at realistic prices.

Geoff Miller, 1987

1.0 INTRODUCTION

Countries whose agricultural orientation is toward export markets have their attention very much focused on the international arena, bilateral and multilateral. Even though the world economy has shown steady growth and resilience over the past four years, traded agricultural commodities have not benefited. Volume is stagnating and value has declined leading to a deterioration in the terms of trade for agriculture with respect to the manufacturing sector (FAO, 1987).

The grains and livestock sectors have been subject to this same poor performance. Net cereal exports for 1986/87 are projected at 146 million tonnes (mt) (FAPRI, 1987), some 25 percent below the peak reached in the early 1980's. United States (US) farm wheat prices, which largely determine world prices, are some 40 percent lower than in 1980 and world wheat prices faced by other exporters are even lower, once export subsidies are taken into account. Canada's projected farm price of wheat for 1987/88 is $ 116/tonne for No. 1 CWRS at ThunderBay and this reflects the impact of export subsidies on top of already low US prices and is roughly one-half the highest price received, $ 222/tonne in 1980/81.

There are many factors that contribute to explaining this collapse in

world agricultural markets[1]. The fundamental symptom is that available export supply has exceeded import demand since 1981/82, largely as a result of a 25 percent decline in world import demand for grains with no parallel adjustment on the supply side. As a result of this imbalance a large surplus stock accumulation overhangs the market with little prospect of it quickly dissipating with existing policies. The US holds the major portion of these surplus stocks of corn, and to a lesser extent wheat. These stocks reflect the cumulative effect of high support prices during the early 1980's that resulted in the maintenance of very high production levels in the face of shrinking demand. Similarly, high real prices for grain in the European Community (EC) caused production to expand to the extent that the EC became a significant net exporter of both wheat and coarse grains by the mid 1980's. This market imbalance has led to a substantial increase in government costs and to considerable international friction as the major grain exporting nations compete to maintain export volumes and market shares.

Domestic support policies and their related border measures that are found in every country have been isolated as the major causal factor for the current dilemma facing world agricultural markets (OECD, 1987c). When world markets are seen strictly as a safety valve for domestic markets there is little wonder that prices are considerably lower and more variable than they would be with fewer market distortions as shown by Tyers and Anderson (1987)[2]. This study also demonstrates very clearly that agricultural protectionism and therefore market distortion has been increasing over the

[1]For a comprehensive review of the world situation see OECD (1987c) or Hathaway (1987).

[2]Other studies such as Parikh et.al and Roningen et.al. estimated the impact of liberialization and found a similar price depressing effect caused by border distortions in price transmission.

last two decades in the food importing industrialized countries, and also in newly industrialized countries. These studies are based on the situation that existed in the early 1980's, however, government expenditure on agricultural programs has grown substantially since that time. By 1985 government expenditure in the US, Canada, Australia and the EC roughly doubled relative to the 1979-81 period (OECD, 1987c).

Agricultural trade has been placed high on the GATT agenda for the current round of negotiations initiated at Uruguay in October 1986. The Punta de Este Ministerial statement conveys the intent to bring agricultural trade fully into the GATT (OECD, 1987c; Hathaway, 1987). Since domestic support policies cause most of the current trade distortions, countries are going to have to alter their domestic policies if significant progress towards this objective is to be made. Economic analysis will play an important role in this round of the GATT negotiations.

Researchers are being called on to specifically incorporate trade impacts into the policy development process and to support the multilateral trade negotiations (MTN). This is often unfamiliar territory with few guidelines as to trade's priority within the host of issues, mainly domestic, that are found in any single policy or program. The complication arises in that the actions of other nations have to be explicitly taken into account whereas in the past they were basically ignored. The demand is for new mechanisms to support domestic agriculture that do not possess the trade distorting effects of current subsidy programs. This has brought the discussion on program "decoupling" and "neutrality" to the forefront as to what they mean and how they can be achieved. They are proving to be very allusive concepts. This issue of neutrality, along with market access and

workable trade rules for agricultural products, would appear to be of fundamental importance if countries are going to be able to meet the new set of trade obligations being discussed internationally.

The remainder of this paper looks at one example of dealing with the current imbalance in the world cereals market. Both the domestic and international implications of a cooperative grain supply reduction agreement are considered. An important feature is the international cooperation required to carry out the analysis. This is a quantitative analysis in which the response to this specific proposal will be tested and evaluated using existing economic models. Background information is provided in Section 2 along with a brief description of the current situation. Section 3 deals with methodological issues involved in setting up the problem. Section 4 will deal with the approach to a cooperative program by a number of exporters and the basic assumptions made in implementing the program in the models used. Section 5 summarizes the results and the last section will conclude by discussing both the process and the results that may be of interest in an international forum.

2.0 THE CANADIAN AND WORLD GRAIN SITUATION

The Canadian grain sector is important both domestically and as an export industry. Twenty-five percent of total farm cash receipts came from marketed grains in 1986, excluding government support payments. Grain exports earned Canada some $4.5 billion dollars in 1986, contributing about 4 percent to total merchandise exports. Besides direct shipments, indirect exports accrue through livestock products such as beef, pork and their

by-products. Together grains and livestock contributed approximately $6 billion to the total value of exports. The agricultural trade surplus was some $4 billion, equivalent to roughly 50 percent of Canada's total merchandise trade surplus in 1986.

The grains sector's contribution to export earnings has declined significantly since 1983/84. Volume has been a factor in some years due to drought with exports of wheat declining by 4 million tonnes from 1983/84 to 1985/86, recovering in 1986/87. Price is the main reason as the export price of wheat fell from $ 247 in 1985/86 to a projected value of $ 168 in 1987/88 (Table 2.1), well below the highs of over $260 a tonne reached in the early 1980's. In real terms Canadian wheat price is at record lows as clearly indicated in Figure 2.1. Lower prices since 1986 are directly attributable to changes in US farm policy incorporated in the Food Security Act of 1985 (FSA85) which reduced loan rates and implemented export subsidies through the Export Enhancement Program (EEP).

The financial pressures faced by individual Canadian grain farmers is severe. Current low market prices are not sufficient for many farmers to cover operating costs as well as debt payments. At the same time land prices have declined significantly and debt pressures carried forward from the early 1980's still persist. It is estimated that twelve percent of Canadian farmers who borrow are experiencing financial difficulty at this time (Agriculture Canada, 1987a) with many farmers going bankrupt, or simply leaving their farms. The farm credit system is also under strain. The federal Farm Credit Corporation (FCC), a major agricultural lender of long term capital, is in need of refinancing if it is to survive as currently 21 percent of its borrowers are in arrears (Agriculture Canada, 1987a). The

TABLE 2.1: Canadian Agricultural Indicators with Baseline Forecast, 1987/88 TO 1991/92

	1985	1986	1987	1988	1989	1990	1991
			---------- Forecast ----------				
Crop Year							
CROP AREA, CANADA (million hectares)							
WHEAT	13.73	14.09	13.51	13.58	13.58	13.62	13.95
BARLEY	4.77	4.91	5.10	4.84	5.05	5.29	5.58
CORN	1.28	0.99	1.00	1.02	1.06	1.07	1.13
GRAIN PRODUCTION (Million Tonnes)							
WHEAT	24.38	31.60	26.4	27.2	27.6	28.2	29.4
BARLEY	12.48	15.00	13.3	12.9	13.8	14.8	15.9
CORN	7.58	6.10	6.0	6.2	6.6	6.7	7.2
GRAIN ENDING STOCKS (Million Tonnes)							
WHEAT	8.68	13.38	12.0	11.5	10.6	8.6	7.2
BARLEY	3.38	3.58	3.1	2.4	2.6	3.5	5.0
CORN	1.00	1.60	1.0	0.4	0.1	0.3	0.7
GRAIN NET EXPORTS (Million Tonnes)							
WHEAT	17.78	21.00	22.0	22.0	23.0	24.5	25.0
BARLEY	3.00	6.00	5.5	5.6	5.8	6.0	6.2
GRAIN PRICES ($/Tonne)							
WHEAT (a)	246.65	184.23	168.13	165.60	176.64	190.99	212.71
BARLEY (b)	103.13	82.77	65.77	68.29	72.10	92.79	99.75
CORN (c)	114.51	86.84	81.52	77.69	83.72	101.72	107.54
Calendar Year							
LIVESTOCK PRICES ($/cwt)							
STEERS (Calgary)	74.33	73.70	80.20	79.61	81.12	77.91	75.36
HOGS (Ontario)	68.50	81.57	75.01	61.60	61.91	72.84	73.25
REALIZED NET FARM INCOME							
($ million)	3912.00	4866.00	5181.00	3172.00	2933.00	3335.00	4095.00
GOVERNMENT PAYMENTS (d)							
($ million)	2100.00	2800.00	3900.00	2800.00	2100.00	1600.00	1400.00
SHARE OR NFI FROM GOVERNMENT PAYMENTS	54%	58%	75%	88%	72%	48%	34%

a. Wheat 1 CWRS 13.5% St. Lawrence

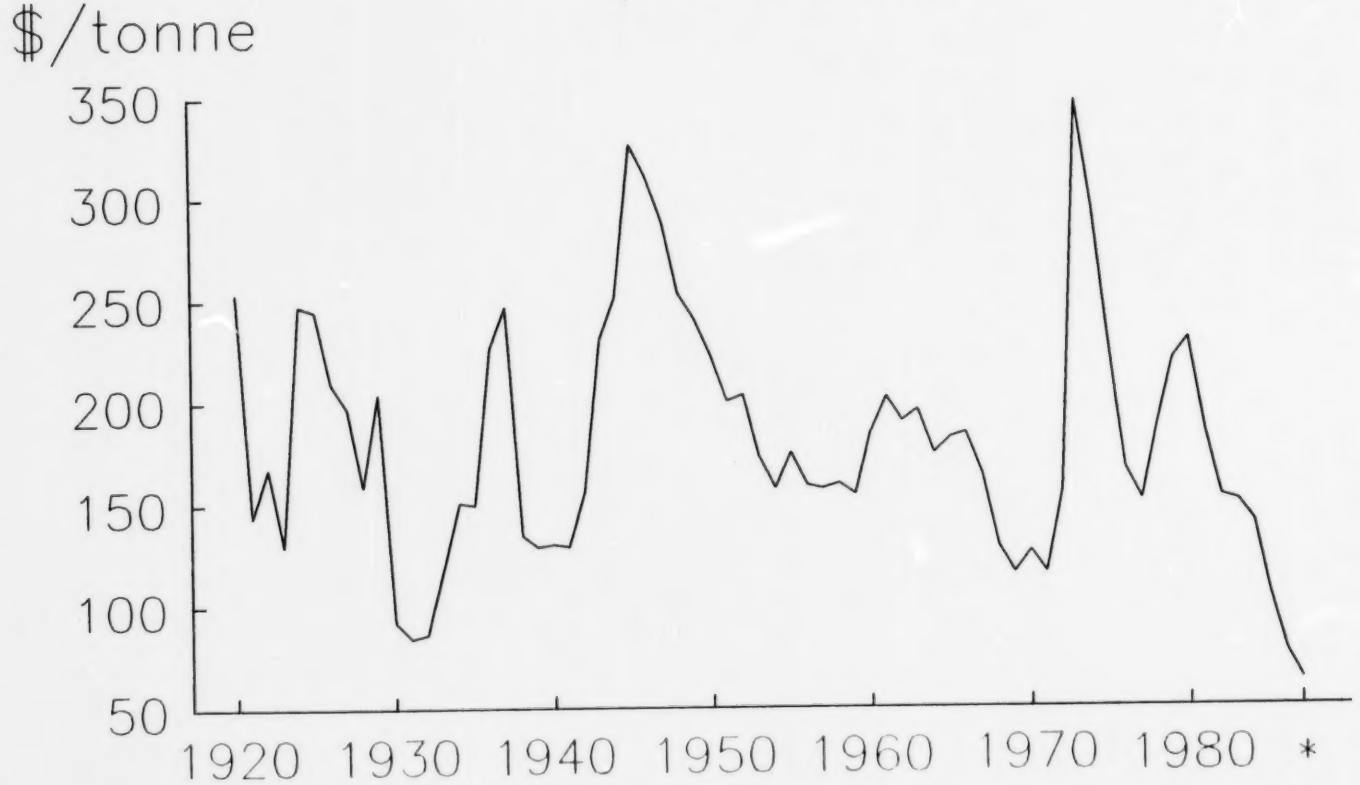
b. Barley 1 Feed, Winnipeg Commodity Exchange, Thunder Bay

c. Corn 2 CE, Chatham elevator

d. The $ 1 billion Special Canadian Grains Program was paid in 1987.

Source: Medium Term Forecast, Agriculture Canada, July 1987.

Figure 2.1: AVERAGE CROP-YEAR FARM PRICE, ALL WHEAT ON PRAIRIES
(Deflated, 1981 = 100)



* Estimated 1987/88

Source: STATISTICS CANADA, Average Farm Price Per Tonne, All Wheat (Prairies) and Consumer Price Index, All Items, Canada (1981 = 100)

existing farm income safety net programs have proven to be insufficient to compensate the grains sector for severely depressed world prices. Besides record payouts from the Western Grain Stabilization Act (WGSA), an ad hoc Special Canadian Grains Program (SCGP) paid out $ 1 billion for the 1986 crop and a follow up program for 1987 has been promised to protect Canadian farmers from the US-EC trade wars.[1]

The dominant role of the US in the world's grain market over the last two decades is well recognized and has been discussed in numerous studies. In the coarse grains market this leadership role can be directly attributed to its dominant export market share. For the remainder of this decade the US's market share is expected to exceed 60 percent (Table 2.2). The US dominance is not as strong in wheat, but it is still by far the largest exporter and is expected to capture some 35-40 percent of the world market over the medium term, followed by Canada, Australia and the EC. US domestic policies also play a significant role, especially in periods of excess supply, reinforcing this dominant position. Previously, the design of the US support program meant the US was willing to remove from the market a volume of grain sufficient to maintain domestic and world prices at or above the loan rate (USDA, 1986). The loan rate provided an effective floor for world price. To prevent stocks from becoming too large, production controls are another feature of US programs. In effect the US has been willing to accept the role of residual supplier to the world for grains in periods of excess supply.

When FSA85 was passed in December 1985 the loan rate ceased to provide

[1]On Dec. 15, 1987 the Federal government announced additional support. This included a $1.1 billion SCGP for 1987, a write-off of $750 million from the WGSA deficit and substantial funds for FCC.

TABLE 2.2: WORLD GRAIN PRICES AND EXPORTS (1986/87) WITH BASELINE FORECAST, 1987/88 TO 1991/92

	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
				Forecast		
US GRAIN PRICES ($US/Tonne)(a)						
WHEAT (1 HRW,GULF)	108.0	98.5	96.3	104.0	114.0	128.0
CORN (Chicago)	63.1	61.0	58.0	63.0	77.0	83.0
WHEAT NET EXPORTS (Million Tonnes)(b)						
WORLD	78.1	86.0	90.7	93.7	95.9	97.7
US	26.5	32.1	35.5	36.9	37.8	37.6
EC	13.6	12.2	13.9	14.2	14.4	14.5
CANADA	19.0	22.5	20.6	21.0	21.2	22.3
AUSTRALIA	14.5	14.1	14.7	15.2	15.7	16.1
ARGENTINA	4.5	5.1	5.9	6.4	6.8	7.2
US TRADE SHARE	34%	37%	39%	39%	39%	38%
COARSE GRAIN NET EXPORTS (Million Tonnes)(b)						
WORLD	71.2	71.7	78.6	80.8	83.3	88.0
US	45.6	47.9	53.1	53.5	54.9	58.4
EC	1.2	0.3	0.8	1.2	1.1	1.5
CANADA	5.8	4.1	4.6	5.3	5.6	5.9
AUSTRALIA	4.0	3.3	3.4	3.6	3.7	3.8
ARGENTINA	6.6	7.9	8.1	8.4	8.7	8.8
US TRADE SHARE	64%	67%	68%	66%	66%	66%

Sources: a. Medium Term Outlook, Agriculture Canada, July 1987.
b. Food and Agricultural Policy Reasearch Institute, Staff Report #3-8 July, 1987.

an effective market floor price. The US is no longer willing to accept the role or cost of being the residual world supplier of grains. US government stocks are being released onto the market through the use of Payment-in-Kind (PIK) certificates and downward pressure on world prices is exacerbated by the mandated use of export subsidies (EEP) on the world market by the US. With supply exceeding demand, other grain exporters have had to match low and subsidized US prices to prevent loss of markets. However, the loan rate, target price and associated deficiency payments continue to support US grain producers' incomes.

Current forecasts do not indicate a quick return to the levels of prosperity enjoyed during the late 1970's and early 1980's for the grains sector. Medium term projections for price indicate some strengthening, but not to past levels. The medium term forecast for US wheat is $US 96 per tonne at the Gulf for 1988/89, recovering to $US 128 per tonne by 1991/92 (Table 2.2). In 1983/84 the US export price was $153 per tonne by comparison. Growth in the volume of world grain trade is also projected to be slow compared to the 1970's at 3 percent a year and it will be the end of the decade before previous world export levels are reached once more. Of course this forecast is based on the premise of current policies being maintained, average global weather conditions and specific structural assumptions about the world market that are incorporated into the econometric models used to generate these forecasts.

For grain exporting nations this means that government support will continue to be a major source of farm income over the next several years if

farm income is to be maintained at present levels[1]. In the US, government payments are projected to be the source of 50 percent of Net Farm Income (NFI) from 1987 to 1991 costing the US treasury $US 15 billion annually (Table 2.3). In Canada for this same period it is estimated that government payments will average $ 2.4 billion[2], comprising over 60 percent of Realized NFI (Table 2.1). Although market conditions indicate the need to reduce the level of resources committed to agricultural production, the support programs currently in place in Canada and in most other countries, will significantly slow down or prevent major resource adjustment from taking place, including adjustments which may be required.

In terms of resource adjustment, the US is attempting to deal directly with reducing production. The FSA85 requires some 20 to 30 percent of "base" wheat and corn land to be idled each year for producers to remain eligible for deficiency payment based on support prices which have remained virtually the same from the previous 1981 farm legislation. Support or target prices for wheat and corn for 1987/88 are $US 4.38 and $US 3.03 per bushel, respectively. In addition, the FSA85 mandates the creation of a 40 million acre land conservation reserve by 1990. To a large extent the current "trade war" initiated by the US against the EC, as well as other exporters, is over this issue of who will share in the burden of adjustment now required to bring the world markets back to a more balanced situation with export supplies much closer to current levels of import demand.

National support programs do provide producers with significant economic rents and they will resist any move to reduce or eliminate these

[1]For 1979-81 the OECD (1987b) estimated that domestic agricultural support already cost member governments and consumers some 112 billion ECU's annually. Since then support has increased dramatically.
[2]The additional assistance for Canadian farmers announced in December 1987 is not included in this value.

TABLE 2.3: U.S. AGRICULTURAL INDICATORS AND BASELINE FORECAST, 1987 TO 1991

	1986	1987	1988	1989	1990	1991
			Forecast			
LIVESTOCK PRICES ($US/cwt)						
OMAHA STEER	57.71	64.99	68.00	68.63	66.83	62.23
HOGS 7-MKTS	51.19	50.51	39.67	36.41	33.22	37.58
ENDING GRAIN STOCKS (Crop Year, million bu.)						
WHEAT	1,848	1,820	1,634	1,439	1,191	1,077
CORN	5,115	4,743	3,979	3,400	2,871	2,724
GRAIN ACREAGE (Crop Year, million acres planted)						
WHEAT	72	65	63	64	63	67
CORN	77	68	64	66	66	70
NET FARM INCOME (nominal) ($US million)	28,300	35,500	33,800	30,600	25,300	23,100
GOVERNMENT PAYMENTS ($US million)	11,400	17,200	16,800	15,600	13,100	11,500
SHARE OF NFI FROM GOVERNMENT PAYMENTS	40%	48%	50%	51%	52%	50%

Source: Food and Agricultural Policy Research Institute, Staff Report #3-87, July 1987.

rents. Unfortunately, research dealing with the gains from trade liberalization does not address the question of compensation for sector(s) that will suffer losses in economic welfare. If the industrialized countries had liberalized food policy in 1980-82 Tyers and Anderson (1987) estimated that the gain in net economic welfare in these countries would have been 20 percent. However, overall producer welfare in these countries would have fallen by some 58 percent, largely in western Europe. In another study on the impact of OECD agricultural trade liberalization Parikh et. al. (1986) estimate that real agricultural prices will increase by 9 percent and export volumes will expand considerably through better resource allocation and specialization. However, not every sector or country is a net beneficiary, Canada being a case in point[1].

This raises the question of how successful the Uruguay MTN's of GATT will be in reducing or modifying domestic subsidy programs that distort trade when these programs are not only seen as vital to producers' survival, but also confer sizeable economic rents to agriculture and vary substantially from one country to the next. While this study will not address possible outcomes of the MTN's or of rent seeking and compensation, it will look at a short term, commodity specific program of joint action by exporters to improve market conditions and allow producers to become less dependent on government support programs for adequate returns.

[1]The welfare indicators for Canada in 2000 with trade liberializtion were marginally negative due to the increasing cost of consumption in in the later years for consumers (Parikh et. al., 1986, p. 5.35-39)

3.0 METHODOLOGY

Policy makers require information on what domestic policies distort trade and by how much. They also need information on the impacts changes in policies to reduce trade distortions will have on prices, production and the welfare of consumers and producers, as well as government budgets. One source of information is provided by quantitative economic models. Models are an efficient way to organize large amounts of factual information. Besides providing analysts with a detailed representation of the economic environment, models can also provide a timely response in a format that can be interpreted by others not directly involved in operating the models. The OECD (1987c) Ministerial Trade Mandate study is one example of the effort being made to supply countries with the quantitative information they require to negotiate agricultural trade reform.

Several different types of economic models have been developed at Agriculture Canada to meet the demand for information by Canadian policy makers (Zuhair and Nyarayanan, 1987). These models include a large dynamic econometric model (FARM), a static regional programming model (CRAM) and a general equilibrium input-output (IO) model with a disaggregated agricultural industry. The latter two models are fairly recent developments. The three models have different structures, data bases and solution algorithms and therefore have different strengths and weaknesses in terms of the problems that can be analysed and the information they will provide. These models were built and have been maintained largely to address domestic issues, although international trade is explicitly incorporated into them. The three models have not been used in an integrated fashion to date, nor have they been used to analyse issues that

may arise out the current trade negotiations.

In carrying out this project, a number of decisions are made regarding the use of the various models. The analysis period selected is 1987 to 1991 so that existing medium term forecasts can be used for comparative purposes. The policy shock is introduced in 1987/88 crop year so that the impact can be evaluated over a five year period. This is important for the livestock industries because of their lagged adjustment character. Both CRAM and the IO model are static in nature and can be adjusted to any period.

In dealing with trade issues a shortcoming of Agriculture Canada's domestic models is that world or US prices are treated exogenously[1]. For forecasting purposes composite US price projections are put together from published US forecasts (the Wharton Econometric Forecasting Associates Group, USDA, and FAPRI) and utilized in FARM. In this analysis the world (and US) price response to reduced output levels by major grain exporters is required. FAPRI[2] cooperated in this analysis using its annual econometric model and its current long term forecast as a comparative basis. The FARM and FAPRI baseline forecasts do not correspond exactly but are judged to be reasonably similar.

No attempt is made to ensure consistency between the four models employed in this analysis in order to test and assess the strengths of the various models in terms of the information that they will provide. In this

[1]Agriculture Canada is developing a world agricultural trade model but it was not completed when this analysis was conducted.
[2]FAPRI stands for the Food and Agricultural Policy Research Institute and includes its sister agency, the Centre for Agriculture and Resource Development (CARD) at Iowa State University.

sense the models are run independently and the unadjusted results from each model will be presented. This will give rise to differences in results for similar variables which will need to be explained based on the structural characteristics of each model. If the models are to play a useful role in the decision making process, the synthesis of this large information base into a comprehensive package becomes the most important job of the modeller.

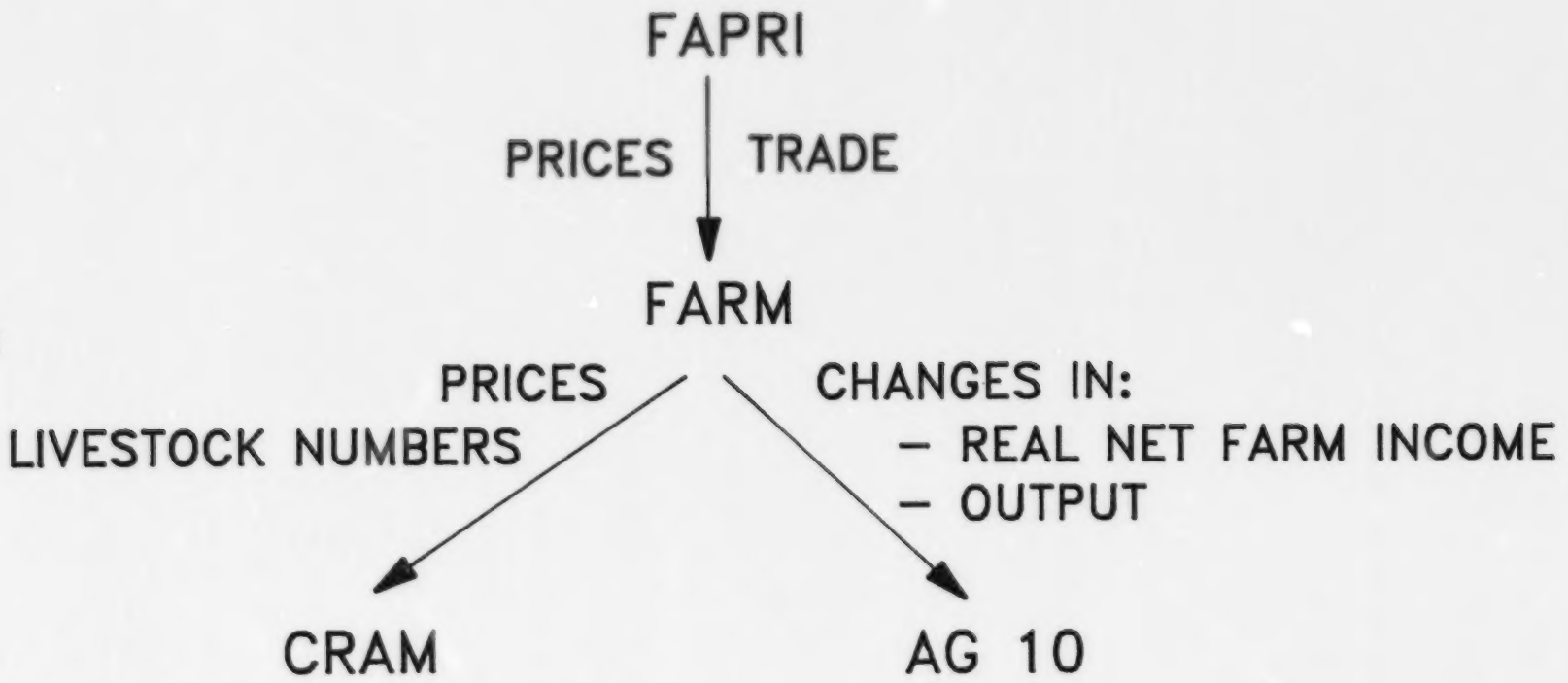
3.1 MODEL LINKAGES

To run the models in an integrated fashion, information has to be transferred between the four models. A schematic representation of this transfer is shown in Figure 3.1. The FAPRI model provides information on the percentage change in world and US grain and livestock prices between its baseline forecast and the policy scenario. Exogenous US prices in FARM are then adjusted by the equivalent percentage change for the policy experiment. For consistency, FAPRI's estimates of Canadian exports of wheat, barley and corn are imposed on the scenario in FARM. The baseline and scenario results from FARM provide the necessary information to incorporate into the CRAM and the IO models. Prices and livestock numbers from FARM's baseline and scenario results are used in CRAM. Changes in real Net Farm Income and output levels from FARM are used in the IO model. A brief description of the models and how they are setup for the analysis follows.

3.2 MODELS USED IN THE ANALYSIS

Canada is modelled as a small open economy when it comes to the grains and livestock sectors in Agriculture Canada's models. A model which

FIGURE 3.1: FLOW OF INFORMATION



includes the major grain producing, consuming and trading nations, and endogenizes world and US prices, is required. The FAPRI model fulfils this need by determining, simultaneously, world and US prices, net trade and domestic demand and supply aggregates of the major grain producing and consuming countries. In its structure the FAPRI model consists of three sub components; the US grains sector, the US livestock sector and a world trade model for grains (Appendix A). The three sub components operate interactively to solve for US and world prices that will clear the market (FAPRI, undated). The Canadian component of the FAPRI trade model is specified differently and is not as comprehensive as the grain component of FARM, especially in the way acreage is determined[1]. The importance of this difference will be discussed later.

FARM is a quarterly econometric model which is used primarily for domestic forecasting and also for policy simulation and analysis. Currently, FARM consists of over 1100 equations. It is a multi-commodity model constructed on an east-west basis with well specified interaction between the grains and livestock sectors (Appendix B). In forecasting, grain export volumes are exogenously determined. Farm income as well as major government support programs for grains and red meats are endogenous to the model. Farm resource use, consumer food prices and sector performance indicators are also determined in the model. This model is used extensively for forecasting and these forecasts are integrated into Agriculture Canada's Market and Outlook process. FARM has recently been documented in Johannsen (1986).

[1]In FAPRI wheat, corn and barley acreages are estimated seperately with cross-price effects. In FARM a systems approach is used to allocate western acreage using a multinomial logit model.

CRAM is a spatial, multi-commodity linear programming model (Webber et.al., 1986). At this time, the model consists of 29 crop production regions with livestock production and demand modelled at the provincial level. The grains and red meat sectors are well developed and the level of disaggregation provides considerably more information on regional and provincial impacts than FARM. CRAM is employed in this analysis to investigate alternative means of implementing an acreage diversion program in Canada. Prices and livestock numbers are exogenous to CRAM and are obtained from FARM projections. Crop supply is endogenous and it is this special feature of the model that is being exploited in this analysis. Crop production responds to relative prices in selecting the optimum crop mix and it also responds to profitability as it selects between fallow and stubble cropping alternatives. Generally as price falls, the use of summerfallow increases, decreasing seed acreage and production (MacGregor and Graham, 1988). In CRAM, grain exports are determined after provincial demands for food, industry and feed are met by production and interprovincial shipments. Stock holding is not incorporated at this time. Grains fed to animals are not valued as a revenue or a cost in the objective function which is a net return specification. Feed demand depends on predetermined animal inventories and marketings. The model does determine the farm value added of all crops that are produced and this is used as a proxy for sector income.

The Agricultural Input-Output model is a general equilibrium model (Thomassin and Andison, 1987a). The basis for the model is the Statistics Canada IO model based on 1981 data which contains 191 industries, one being the entire agricultural sector, and 602 commodities. The Statistics Canada model is modified to disaggregate the single agricultural industry into 12

sectors including wheat, small grains, cattle, hogs, poultry etc. The advantage of this disaggregation is that the macroeconomic impacts of changes in agricultural policy directed at either the commodity or industry can be evaluated.

4.0 A COMMODITY SPECIFIC COOPERATIVE GRAINS PROGRAM

There are a number of ways in which countries can approach the supply-demand imbalance in the grains market. International Commodity Agreements that "manage" world markets represent a formal cooperative mechanism that is used to bring greater stability to some world commodity markets (Schmitz et.al., 1981). Previous attempts to use this mechanism in the world wheat market have not been successful, although for some commodities a degree of international cooperation has been achieved through International Commodity Agreements. Grain export cartels have also been suggested as a way to manage the world market (Schmitz et.al., 1981). A cartel could be used to extract economic rents from importing nations, similar to the objectives of OPEC, or in a less ambitious manner to bring greater stability to the market with higher average competitive prices. However, the conditions for the operation of a successful cartel are stringent, and often their initial success leads to their own demise as higher prices provide incentives for all countries to increase production, whether they are members or non-members. Increased management of the international market is not being sought in the current GATT round by most grain exporters, although countries such as South Korea and Japan may favour such an approach (Hathaway, 1987). Specific forms of price fixing or market share arrangements are not considered. This also rules out consideration of

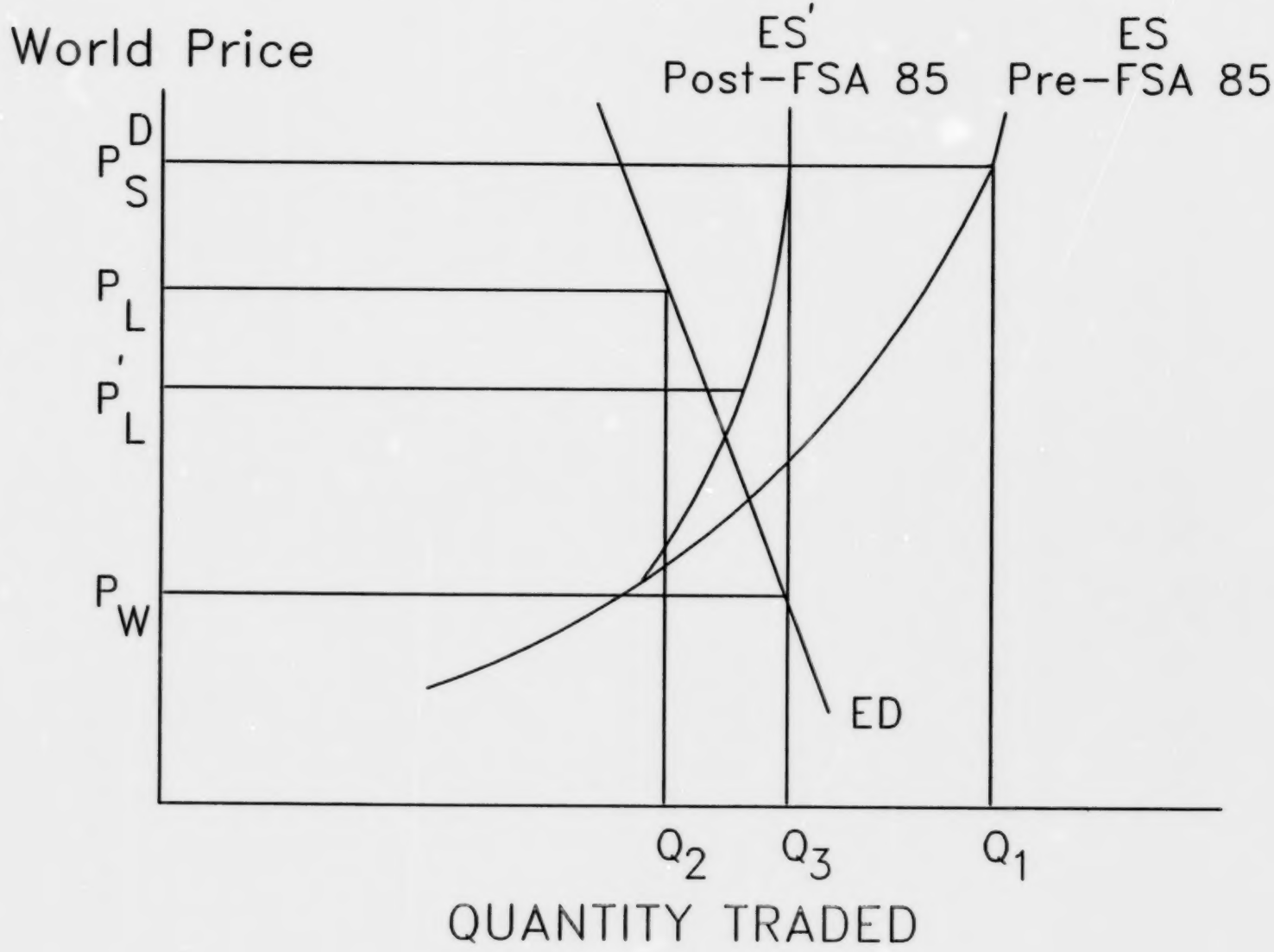
a formal rent seeking export cartel arrangement.

The objective of the commodity specific grains program being evaluated in this analysis is to bring supply and demand into balance at what would be considered the long run world equilibrium price, one that would prevail if distortions did not exist. This is viewed as a short term program to deal with existing excess stocks and once these stocks are eliminated the program would be discontinued. Competitive market forces are assumed to prevail in determining trade and prices within the program. The need to reduce world supplies through reduction in agricultural support is recognized (OECD, 1987a). The Cairns Group (1987) has suggested that for early relief, measures that restrict access to markets be frozen at current levels and budgetary outlays for export and production subsidies also be frozen. Idling land could complement other initiatives in the short term as it is aimed at alleviating the negative stock pressures that currently exist in the world grain market.

4.1 A Model of World Grain Price Determination

A conceptual model of how world grain prices are determined is shown in Figure 4.1. Leading up to the enactment of the FSA85 in the US, high domestic support prices (Ps) in many countries resulted in world excess supplies (ES), defined here as current production plus beginning stocks, exceeding excess demand (ED) at Ps. As explained earlier the US loan rate (Pl) acted as a floor price as the US government was ready to purchase and store any amount of US produced commodity to prevent market prices from

Figure 4.1: WORLD GRAIN PRICE
NO COOPERATIVE PROGRAM



falling below the loan rate, P1[1]. As the US was the residual supplier for the world market, the loan rate became the world floor price. At P1, the difference between ED and ES is Q1-Q2 and represents the amount of product that the US had to place into ending stocks to maintain P1.

After FSA85 was enacted, the US did impose more production controls than existed at ES, thereby shifting their own supply to the left and the world excess supply left to ES'. At the same time they lowered the loan rate from P1 to P'1 (from $US 3.30/bu in 1985/86 to $2.40/bu in 1986/87 for wheat) and instituted programs allowing the world price (Pw) to fall below the loan rate to the extent that ES' equals ED at Q3. The main programs that allow Pw to fall below P'1 are the use of the US EEP for wheat and barley and PIK certificates for corn. Both the EEP and PIK certificates allow for the release of government held stocks by mechanisms other than farmers reclaiming crops that they put under loan. The US still retains control over ES' by the rate at which it releases government stocks built up over previous years.

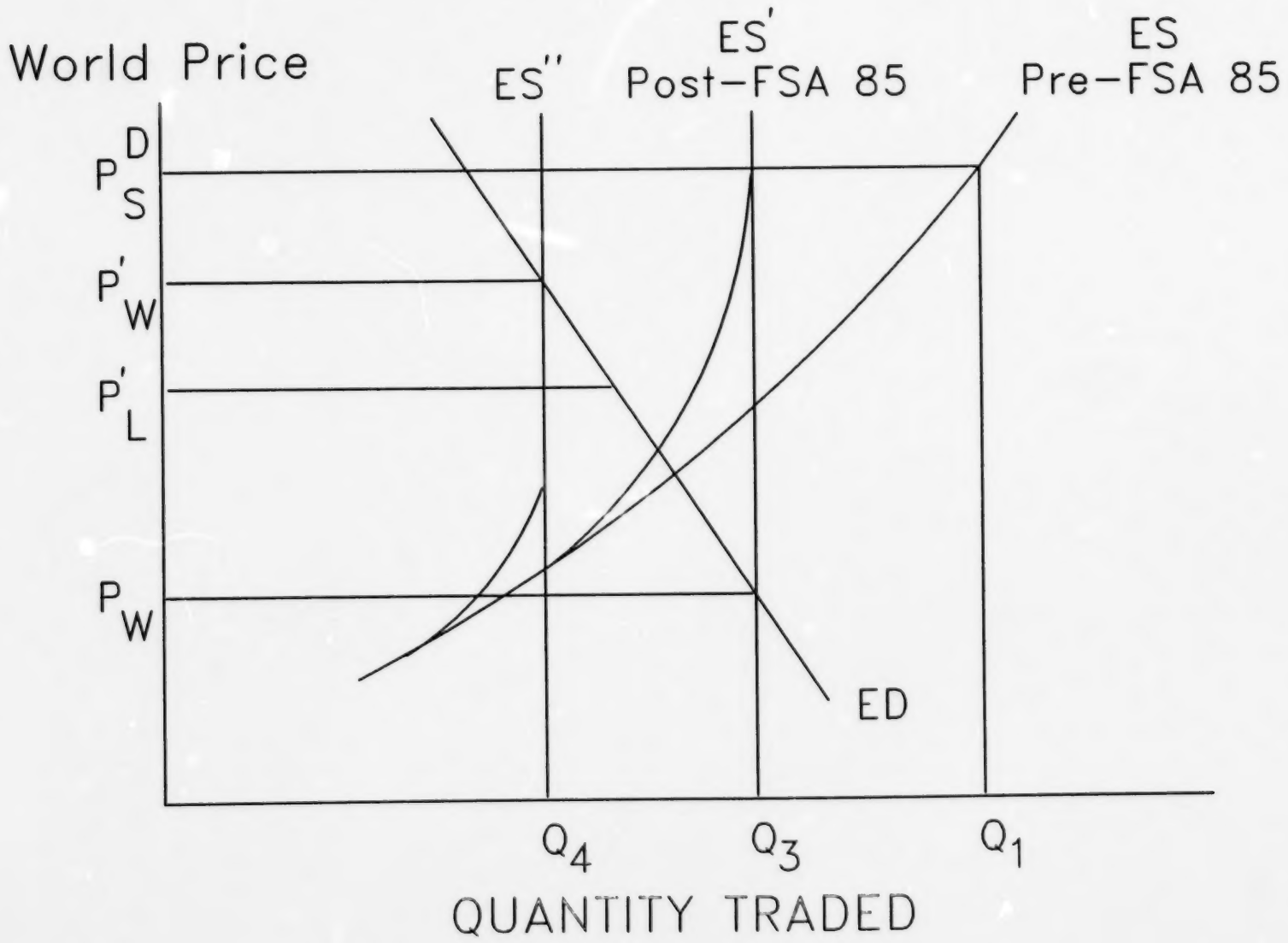
Grain producers in Canada now face Pw rather then P1 or P'1, while US grain producers are still protected by their support price (Ps) and loan rate (P'1). The difference between P'1 and Pw measures the explicit US export subsidy for wheat and barley. For corn the difference between P'1 and Pw represents the impact of PIK certificates, lowering both US domestic prices and world prices below P'1. The US is generally not exporting corn under the EEP as this would put US livestock feeders at a disadvantage to other livestock producers.

[1]USDA (1986) provides a comprehensive discussion on US domestic policy and its effect on world grain markets and prices.

The impact of the cooperative acreage reduction program is shown in Figure 4.2. If the other major grain exporters remove land from grain production, shifting their own supply curves left, then world excess supply will shift further to the left to ES''. To be affective with respect to current US legislation the resulting world price (Pw') will have to be greater than P'1. By definition Pw' represents the world price if a distortion free market prevailed, although this cannot be determined from this model. At Pw', ES'' equals ED at Q4, with ES'' still being partially determined by release of government held stocks. As the government stocks are depleted, diverted acreage is allowed back into production while maintaining Pw'. The need for explicit US export subsidies is eliminated as by definition world supply and demand are back in balance and Pw' is greater than P'1. The more inelastic ED is, the smaller the change in trade will be from constraining ES. Exporting countries continue to set Ps at whatever level they wish, as long as they restrict output to compensate for the distortions caused by such policies. It is assumed that existing US production control programs currently in the FSA85 will remain until such time as ED shifts to the right so that it cuts ES', and eventually ES, above Ps.

In essence the proposed cooperative program supplements current US efforts to unilaterally reduce supply. If all major grain exporters share some of the adjustment burden, it is hypothesized that excessive stocks, which are mainly held in the US, can be eliminated and that prices will strengthen in a much shorter time frame then presently forecasted. Additional changes in participants' domestic or border policies are not assumed in this analysis. It should be noted that as to how each exporter

FIGURE 4.2: WORLD GRAIN PRICE
COOPERATIVE PROGRAM



would impose planting restrictions to comply with the cooperative program requirements are not part of this analysis. It is felt that, if the political will is present, that individual solutions can be found by each cooperating exporter and no requirement for similarity of approach is assumed. The cooperative nature of the program means it will survive only as long as all participants are seen to be abiding by the spirit and intent of the program.

4.2 Implementation of a Commodity Specific Cooperative Grains Program

An ad hoc cooperative program undertaken by the main grain exporters is proposed that will correct for the current world supply-demand imbalance. This analysis assumes agreement to participate in this program can be reached between the five major grain exporters; the US, Canada, Australia, the EC and Argentina. To correct for the current excess supply situation and get rid of burdensome grain stocks, the five exporters agree to idle 10 percent of the land that would otherwise be planted to wheat and coarse grains for a number of years. The idled land is not to be used for other purposes.

It is also assumed that the US EEP will be discontinued and the release of excess US government stocks will be managed by the US to allow for an early positive impact on price from reduced plantings and to maintain price at a higher level until the excess stocks are dissipated. Once excess stocks are eliminated the idled land will be brought back into production, as required, to meet import demand while maintaining the higher equilibrium prices. Importers are not involved, nor is any change in their border or

domestic policies assumed. The implementation of this program in each of the four models follows.

A medium term forecast established by FAPRI in June 1987 provides a baseline out to 1991 against which the cooperative program can be compared (Table 2.2 and 2.3). The baseline assumes that the way the FSA85 is currently implemented will be continued. In the scenario, plantings of wheat and each coarse grain are constrained starting with the 1987/88 crop year to 90 percent of actual plantings in 1986/87 in the US, Canada, the EC, Argentina and Australia. The trend growth in acreage as projected in the baseline for countries other than the US is also eliminated. All other US programs, including the establishment of a 40 million acre conservation reserve, are left in place. The effect of the EEP on world prices is not incorporated in the baseline or scenario. The use of PIK certificates expressed as a percent of deficiency payments is included.

To obtain the scenario solution, release of US government wheat and corn stocks are controlled to achieve predetermined equilibrium price levels. As shown in Figure 4.2, US farm prices of $US 2.10 per bushel for corn and $US 3.00 for wheat are used as the equilibrium prices (Pw') in this analysis. These prices are in line with actual farm prices during 1984 and 1985. Over time total US stocks of wheat and corn are reduced to commercial levels felt to consist of 1 and 2.5 billion bushels, respectively. After stocks reach normal commercial levels, land is brought back into production at a rate that will maintain the equilibrium prices indicated above. From 1989 to 1991, one-third of the diverted wheat acreage is returned each year and one-tenth of the idle corn land is brought back into production. The return of corn land is slower because the original stock burden is greater

than for wheat (Table 2.3). The FAPRI World Trade model for grain assumes that other exporters will export their excess supplies, leaving the US as the residual world supplier and to carry any excess as stocks to support world price (Appendix A.2).

In FARM's baseline, grain prices are adjusted for the US EEP as these are creating a large wedge between subsidized US export prices of wheat and barley and US domestic prices (Pw and P'1 in Figure 4.1). It is the subsidized world prices that Canada must compete against in the export market. In the baseline the price wedge assumed for 1987 is $ 45/tonne for wheat and $ 40/tonne for barley, declining slightly out to 1991. What this means is that Canadian export prices are reduced below the normal Canada-US price difference by this price wedge to take account of explicit US export subsidies and these lower prices are reflected directly back into Canadian domestic prices. The EEP is removed in the scenario.

In the FAPRI Trade and US Grains models the seeded acreage restriction is placed on each individual grain (wheat, barley and corn for Canada). In FARM total seeded acreage is restricted and summerfallow is held constant. This allows the model to determine the impact changes in relative grain prices will have on planting decisions. To be affective the program requires that diverted land be seeded to grass and not summerfallowed. Summerfallowing compensates for reduced seeded acreage through higher yields in subsequent years. From the FARM model a comparative scenario is obtained for the five year program and prices, production, trade, income and government costs will be discussed.

Turning to the CRAM model, a reference solution for 1987/88 is obtained

using FARM baseline projections for 1987/88. In implementing the diversion program in 1987/88 two alternatives are tested. The first is a compulsory diversion in which cropland in each of the 29 crop regions is reduced by 10 percent. No alternative use is made of the land and farmers incur the cost of maintaining diverted land. In the second scenario a paid diversion is tested. For the paid diversion, maximum crop region constraints of 15 percent and provincial constraints of 10 percent are imposed on the amount of land diverted. This is to allow the model flexibility in determining from which regions land will be offered if producers are paid to divert. The diversion payment is set equal to the marginal return to land (the shadow value) at the higher prices projected under the cooperative program.

Grain prices in the CRAM reference solution incorporate subsidy payments from the Western Grain Stabilization Act and the Agricultural Stabilization Act estimated by FARM for 1987/88. The assumption made here is that grain producers take account of expected payouts in making their planting decisions. Grain prices in the scenario runs exclude any government payments to determine the benefit from the increase in market prices in the first year of the cooperative program. The impact of the Special Canadian Grains Program is not considered.

Crop production estimates from CRAM can be compared to FARM and FAPRI crop production estimates, however, the problem posed has been defined differently to obtain information uniquely available from CRAM. The supply response that will occur if seeded acreage is not directly controlled, as in the econometric models, is one aspect of the program being tested in CRAM. The important difference is the impact summerfallow can have on Prairie grain production and how the flexibility this offers producers will affect

export volumes. When summerfallow is used extensively, the correlation between output and seeded acreage is not as strong as it would be where continuous cropping is the norm and this factor may be important in program design in Canada.

The Agricultural IO model provides information on the macroeconomic variables of industrial output, Gross Domestic Product (GDP) at factor cost and employment. To analyse the impact of the acreage set-aside it is necessary to divide the possible impacts into either increases or decreases in final demand for commodities produced in the economy which will come from two source; changes in net farm income (resulting from changes in real prices) which will increase final demand for other goods and services consumed, and, final demand for agricultural output. In the case of changes in NFI, it is allocated to final demand categories using a personal expenditure function which assumes that the average propensity to consume is a close approximation of the marginal propensity to consume. Information on these changes is obtained from the FARM projections of farm income and output. Separate runs of the IO model for increases and decreases in final demand are made and the results aggregated to determine the net impact. The IO model is static so the cumulative impact over the five years (1987-1991) is analysed.

5.0 POLICY SIMULATION RESULTS[1]

5.1 Impacts on World Prices, Trade and the US: FAPRI Model

The improvement in US prices indicate that the cooperative program can have a significant impact. In the first year wheat price increases by 20 percent and corn price goes up by 16 percent (Table 5.1). The higher US prices will closely represent world prices because the EEP is eliminated (Pw' in Figure 4.2). In 1991/92 wheat price is 30 percent above the baseline. Wheat and corn prices in 1991/92 at $US 3.37 and $US 2.16 per bushel, respectively, are in line with the longer run equilibrium prices mentioned above. There is a slight decline in world export levels with wheat down 3 percent and coarse grains down 1 percent over the five years. This indicates a very price inelastic world import demand for grains which is a structural characteristic of the FAPRI Trade model. The small import demand response is felt reasonable given the limited price range and the fact that most major importers use state trading, or other border measures, to isolate their domestic markets from world markets.

An important feature of the cooperative scenario is that production, and therefore exports, are affected in two ways by the acreage restriction. First, acreage is initially restricted to 90 percent of the 1986 level. Second, the natural increase in seeded area captured in the FAPRI baseline is eliminated. This is significant in a number of countries. In the baseline, US planted acreage from 1987 to 1991 averages 12 percent (8.1 million hectares (mha)) below the 1986 level. This is due to the mandatory

[1]The discussion of the results draws heavily on papers by FAPRI (1987), Downey and Charlebois (1987), MacGregor (1987), and Thomassin and Andison (1987b) for the respective models used in the analysis.

TABLE 5.1: IMPACT ON WORLD GRAIN PRICES AND EXPORTS FROM COOPERATIVE ACTION, Simulation Results, 1987/88 to 1991/92

	Baseline 5 Year Avg	1987/88	1988/89	1989/90	1990/91	1991/92
		------ Percentage Change From Baseline -------				
US GRAIN PRICES	($US/Tonne)					
WHEAT (1 HRW Gulf)	108	20%	31%	31%	32%	30%
CORN (Chicago)	68	16%	14%	13%	15%	23%
WHEAT NET EXPORTS	(Million Tonnes)					
WORLD	93	-2%	-4%	-4%	-4%	-3%
US	36	24%	23%	16%	7%	3%
EC	14	-38%	-45%	-36%	-22%	-8%
CANADA	22	-8%	-7%	-2%	3%	4%
AUSTRALIA	15	-11%	-16%	-16%	-16%	-14%
ARGENTINA	6	-25%	-27%	-27%	-25%	-24%
US TRADE SHARE	39%	47%	50%	48%	44%	41%
COARSE GRAINS NET EXPORTS	(MT)					
WORLD	88	-1%	-1%	-1%	-1%	-1%
US	54	17%	20%	23%	23%	22%
CANADA	5	-39%	-46%	-51%	-50%	-51%
AUSTRALIA	4	-3%	-6%	-11%	-11%	-8%
ARGENTINA	8	-14%	-14%	-12%	-11%	-8%
EC (a)	1	-7	-7	-8	-8	-9
US TRADE SHARE	67%	80%	82%	82%	82%	82%

a. The EC shifted from a small exporter to a large importer giving a very high percentage change. The actual volume of net exports is reported.

Source: Food and Agricultural Policy Research Institute, Staff Report #3-87, July 1987.

conservation reserve program, increased set-aside requirements and high program participation rates with low market prices. In the cooperative scenario the US plants roughly the same area in 1987/88 as in the baseline and by 1991/92 it is still seeding 3 percent less than in 1986 as required by the cooperative program. However, over the five years the US seeds roughly 6 percent (3 mha) per year more than it did under the baseline (Table 5.2). Declining participation rates with higher prices, and therefore fewer acres set-aside, is the main reason US acreage is higher in the scenario.

By 1991/92 the other four exporters also plant 3 percent less land than in 1986 due to the remaining restriction on coarse grains. However, they plant 6 percent (4.7 mha) below the acreage seeded in the baseline in 1991/92 due to the elimination of trend growth in seeded acreage. Although the US does comply, it is a beneficiary in terms of higher plantings under the cooperative program as compared to the baseline where it takes unilateral action. However, the US is still diverting significant additional acreage in order to control supply as called for by the FSA85. In terms of the model shown in Figure 4.2, this would be represented by the excess supply curve, ES', not shifting as far to the left when cooperative action is taken as compared to when only unilateral action is taken by the US.

Although trade volume is down slightly, there is a substantial change in the origin of the exports. The US comes out as a major beneficiary in terms of market share from the cooperative program. This advantage arises out of the current large surplus stock position of the US and the need to move these stocks through the system. For wheat the gain is short-lived as

TABLE 5.2: IMPACT ON THE UNITED STATES OF COOPERATIVE ACTION, Simulation Results, 1987/88 to 1991/92

	Baseline 5 Year Avg	1987/88	1988/89	1989/90	1990/91	1991/92
		----- Percentage Change from the Baseline ------				
PLANTED ACREAGE	M Acres					
WHEAT	64	0%	3%	5%	11%	8%
CORN	67	0%	0%	7%	8%	2%
ENDING STOCKS	M Bushels					
WHEAT	1,432	-14%	-27%	-36%	-32%	-25%
CORN	3,543	-4%	-3%	-4%	-5%	-13%
VALUE OF US EXPORTS	$ Million					
WHEAT	3,868	58%	62%	52%	44%	38%
CORN	3,789	41%	43%	44%	49%	58%
PRICE STEERS ($/cwt)	65	1%	3%	4%	6%	6%
BEEF PROD. (B lbs.)	22	0%	-1%	-2%	-2%	-1%
PRICE HOGS ($/cwt)	38	2%	6%	9%	6%	5%
PORK PROD. (B lbs.)	16	-1%	-3%	-3%	-3%	-3%
NET FARM INCOME						
CHANGE (%)		3%	-7%	-6%	-3%	4%
CHANGE ($ B)	38	0.9B	-2.2B	-1.7B	-0.8B	1.0B
GOVERNMENT PAYMENTS						
CHANGE (%)		-8%	-28%	-25%	-29%	-31%
CHANGE ($ B)	15	-1.3B	-3.4B	-3.9B	-3.8B	-3.6B

Source: Food and Agricultural Policy Research Institute, Staff Report #3-87, July 1987.

by 1991/92 the US export volume returns to just 3 percent over the baseline (Table 5.1). By 1991/92, Australia and Argentina wheat exports are still 14 and 24 percent, respectively, below their baseline level due to the elimination of their trend growth in harvested acreage. In coarse grains the US maintains its improved share of the market (over 80 percent) throughout, an indication of the time it will take to eliminate the huge US surplus stock of corn. Canadian exports of coarse grains are down by 50 percent. In the cooperative scenario the EC's reverses its position from that of a small net exporter of coarse grains to a net importer. It also experiences the largest initial percentage drop in its wheat exports, over 30 percent in the first three years. This arises from the fact that EC exports of wheat are much smaller relative to its domestic requirement, and production, than the other four exporters and it is total production that is being reduced.

The major beneficiary in the US of the cooperative program is the government. Because its support prices and other related programs remain the same, higher market prices for grain simply displace government support payments in determining NFI. Government storage costs are also reduced. Annual government expenditure declines by over $3 billion after 1987/88 (Table 5.2). By 1991/92 ending stocks of both wheat and corn are roughly in line with what is felt to be commercial levels. Livestock prices and output are affected by the higher feed grain prices with production down and prices up slightly. Net Farm Income in the US actually falls in the cooperative scenario by 1.8 percent, on average over the five years, because of the impact of higher feed prices . Averaged over the five years, the US volume of total grain and soybean exports is up 15 percent over the baseline. The value of wheat and corn exports increases by an average of 50 percent worth

some $US 4 billion annually.

As an indication of the benefit to Australia and Argentina, a proxy value for the change in their export earnings is calculated using their net exports and US prices for wheat (Gulf) and corn (Chicago). Australia's average export earnings from wheat increase by 13 percent and coarse grains by 7 percent over the five years worth an extra $US 1 billion for the period. Argentina gains in terms of the export earnings of coarse grains by 3 percent annually, but losses a similar amount on wheat sales. The increase in world wheat prices is not enough to compensate Argentina for the 8 mt reduction in wheat exports over the 5 years. Other factors that need to be considered for both countries include; the extent to which their current export price is lower than the baseline US prices due to the EEP, the extent that their domestic prices will increase to reflect rising world prices further improving returns to grain producers, the production cost savings associated with cropping fewer acres, and the advantage their export livestock industries, which are pasture based, will gain from higher grain prices in North America.

The FAPRI Trade model only estimates trade on a net basis. The lack of detail on the mix of EC grain imports and exports makes an assessment of the impact on the EC very difficult. Imports are a source of government revenue through import levies while exports represent a cost to government through export subsidies (restitutions). In the cooperative scenario net EC wheat exports decline by 20 mt over the 5 years. This is an indication of the loss in income EC producers will incur through lower production, however, the EC government will save on the export subsidy required to export this wheat. The EC also saves on export subsidies on its remaining 48 mt of

wheat exports over the five years at higher world prices. In the baseline EC net exports of coarse grains are 5 mt over the 5 years while in the scenario its net imports are 39 mt. This indicates that EC production declines by some 44 mt from 1987 to 1991. A more detailed analysis is required before an overall assessment of the program's impact on the EC can be made.

5.2 Impact on Canadian Agriculture: FARM Projections

Canadian prices for wheat and barley improve immediately due to strengthening US prices and from the discontinuation of the US EEP. The export price of wheat increases by 47 percent in the first year from $ 168 to $ 247 per tonne (Table 5.3). The relative price increase of wheat compared to that of canola and barley , and of barley to corn, may be overstated through the way the EEP price adjustment is incorporated into FARM in this analysis. By 1990 higher export prices provide farmers with a market return of $ 190 to $ 220/tonne (Thunder Bay final price), which are similar in nominal terms similar to the prices received in the early 1980's.

Wheat area expands at the expense of canola and barley and barley feed usage is greatly reduced as corn is substituted. This is in response to the changing relative prices of grains noted above. Even though Canada meets its acreage reduction requirement, its export mix of grains changes dramatically when the seeded acreage of each individual grain is not controlled directly as in the FAPRI Trade model. In 1990 wheat acreage increases by some 23 percent over the base run while barley and canola acreage declines by over 40 percent (Table 5.3). One problem that is not

TABLE 5.3: IMPACT ON CANADA OF COOPERATIVE ACTION, Simulation Results 1987 to 1991

	Baseline 5 Year Avg	1987	1988	1989	1990	1991
		------ Percentage Change from Baseline ----------				
Crop Year						
PLANTED ACREAGE	(M Hectares)					
WHEAT	14	-2%	-1%	11%	23%	9%
BARLEY	5	-10%	2%	-26%	-43%	-7%
CORN	1	-6%	-10%	-9%	-8%	-11%
CANOLA	3	-18%	-38%	-49%	-49%	-59%
PRICES	($/Tonne)					
WHEAT (St. Law.)	183	47%	52%	47%	42%	38%
BARLEY (TBay)	80	62%	51%	24%	65%	47%
CORN (Chatham)	90	18%	16%	16%	21%	28%
CANOLA (Van.)	255	12%	14%	14%	12%	16%
Calander Year						
PRICE STEERS ($/cwt)	79	-1%	-1%	1%	2%	3%
CATTLE MARKETINGS (000 Hd)	3,471	0%	1%	0%	-2%	-3%
PRICE HOGS ($/cwt)	69	-1%	0%	6%	4%	4%
HOG MARKETINGS (000 Hd)	15,427	0%	-1%	-4%	-7%	-7%
	$ Million					
CROP RECEIPTS	8,019	2%	2%	7%	12%	12%
REALIZED NET INCOME	3,743	9%	15%	48%	66%	59%
GOVERNMENT PAYMENTS						
CHANGE (%)		2%	-24%	-32%	-5%	14%
CHANGE ($ Million)	2,360	90	-630	-600	-70	160

Source: Downey and Charlebois, The Food and Agricultural Model: Capabilities and Use, Agriculture Canada, August 1987.

corrected in the scenario run resulted from the exogenously imposed export levels of grain. Stocks are residual in the model and for corn and wheat they are unrealistic in the scenario. Wheat stocks are twice the normal levels. This indicates that setting up the problem in the different models is critical if comparative information is to be gained.

Canadian livestock prices directly follow US prices and output reacted similarly. By 1991 cattle marketings are down by 3 percent and hog marketings are down by 7 percent (Table 5.3) with most of the drop in pork and hog production resulting in lower export levels. Higher feed grain prices are the cause of the decline in the livestock sector. Feed grains are a major cost component and in the Prairies the farm price of barley increases by as much as 60 percent as compared to the baseline. In the scenario Canadian livestock stabilization programs are estimated to pay out an additional $300 million over the 1987 to 1991 period, an increase of 35 percent.

The Canadian agricultural sector benefits from participating in the acreage reduction program which includes an end to the US EEP. Realized Net Farm Income is over 50 percent higher in the last three years of the program, mainly due to an increase in crop receipts which are up by 12 percent in 1990 (Table 5.3). In the first couple of years little change in crop receipts is noted because of the delay before final payments are made in Canada's Prairie region and higher price are offset by reduced government payments (WGSA). Over the 5 year period the government reduces stabilisation payments to the grain sector by $1.4 billion, providing a net saving of $1.1 billion after taking into account the livestock sector. This understates the actual improvement in output due to the wheat stocks problem

mentioned earlier and only takes into account existing support programs and not additional ad hoc programs such as extensions to the Special Canadian Grains Program that paid out $1 billion for the 1986 crop and will pay out $1.1 billion for the 1987 crop.

5.3 Alternative Diversion Programs for Canada: The CRAM Model

The CRAM model is a normative model and therefore its results will not necessarily correspond to the results from FARM or FAPRI. One important element is the optimum crop rotation selected in relation to summerfallow acreage in CRAM. In FARM, summerfallow acreage is set at 8.6 mha for the five years while in CRAM only a lower bound of 7.8 mha is predetermined. This is the minimum level observed for summerfallow acreage. In the reference run using grain prices that reflect projected market returns and support payments for 1987/88, 10.8 mha are summerfallowed. This is interpreted as the equilibrium situation that would exist if farmers had perfect knowledge or after full adjustment takes place to lower prevailing prices. The implication of this is that the summerfallow acreage will continue to increase if projected baseline prices and subsidies remain. In the scenario summerfallow declines to 8.6 mha. Part of the change can be accounted for by the diversion requirement. Roughly half the reduction in summerfallow area is due to intensification as farmers respond to higher grain prices by stubble cropping more land.

With either a compulsory or paid diversion, grain production and shipments are similar. Total grain shipments to ThunderBay and Vancouver are down 3 percent (Table 5.4) with Canada setting aside 10 percent of its

TABLE 5.4: COMPARISON OF GRAIN AND OILSEED SHIPMENTS FROM THE PRAIRIES WITH ACREAGE DIVERSION (Simulation results for 1987/88)

	BASE RESULTS	COMPULSORY DIVERSION		PAID DIVERSION	
	Shipments	Shipments	% Change	Shipments	% Change
		(000's tonnes)			
SOURCE AND DESTINATION					
PRAIRIES TO VANCOUVER AND THUNDER BAY					
WHEAT NO.1	9,566	8,893	-7%	9,046	-5%
WHEAT NO.2	6,749	6,173	-9%	6,202	-8%
WHEAT NO.3	6,518	5,950	-9%	5,937	-9%
WHEAT FEED	2,335	2,073	-11%	2,045	-12%
TOTAL WHEAT	25,168	23,089	-8%	23,230	-8%
COARSE GRAINS	5,550	7,411	34%	7,374	33%
FLAX	411	392	-5%	394	-4%
CANOLA	1,022	229	-78%	221	-78%
TOTAL SHIPMENTS	32,151	31,121	-3%	31,219	-3%
THUNDER BAY TO EASTERN CANADA					
WHEAT NO.1	1,098	1,150	5%	1,150	5%
WHEAT FEED	1,352	1,352	0%	1,352	0%
COARSE GRAINS	1,970	2,521	28%	2,522	28%
TOTAL SHIPMENTS	4,420	5,023	14%	5,024	14%
THUNDER BAY AND VANCOUVER TO WORLD					
WHEAT NO.1	8,272	7,514	-9%	7,667	-7%
WHEAT NO.2	6,748	6,173	-9%	6,202	-8%
WHEAT NO.3	6,517	5,950	-9%	5,938	-9%
WHEAT FEED	844	574	-32%	545	-35%
TOTAL WHEAT	22,381	20,211	-10%	20,352	-9%
COARSE GRAINS	3,225	4,651	44%	4,614	43%
FLAX (a)	411	392	-5%	394	-4%
CANOLA	1,022	229	-78%	221	-78%
TOTAL SHIPMENTS	27,039	25,483	-6%	25,581	-5%

(a) Model does not account for domestic disappearance of flax.

Source: MacGregor, Capabilities, Complementarity and Substitutability of Alternative Models: Agriculture Canada's Experience, 1987.

cropland (3 mha) normally seeded to wheat and coarse grains, including the related portion of summerfallow. After domestic demand is met wheat exports fall by 10 percent, as expected. However, coarse grain exports increase by over 40 percent. The net impact is a 4 percent decline in exports, including oilseeds. Canada did not achieve a reduction equivalent to the acreage set-aside because of farmers ability to shift from fallow cropping to stubble cropping, mainly barley, and increase relative output. Barley acreage increases in the northern regions of the Prairies where it is more competitive with the lower qualities of wheat normally harvested, especially for stubble crops. This response is opposite to FARM where barley acreage declines. FARM does not reflect regional quality differences for land or grain, or the fallow-stubble output relationship of the various crops.

The CRAM model calculates the farm value added of crops produced, excluding forage. Without a diversion payment value added improves by 12 percent for Canada, roughly $3.6 billion (Table 5.5). Improvement in market price levels is responsible for this improvement but producers do not receive the full benefit of the increase in market prices. In 1987/88 the final price of wheat at ThunderBay increases by 54 percent. Thirty-five percent of this constitutes a subsidy offset for the stabilization payments included in the reference run prices. Only market returns are incorporated in the scenario runs to determine the program's impact before including any support payments which may still occur, but at reduced levels, as market prices improve. The other factor contributing to the increase in farm value added is a decrease in cropping costs of 3 percent associated with planting fewer acres in the scenarios.

A paid diversion is estimated to cost the Canadian government as much

TABLE 5.5: COMPARISON OF THE FARM VALUE ADDED OF GRAINS AND OILSEEDS
(Simulation results for 1987/88)

	BASE RESULTS	COMPULSORY DIVERSION		PAID DIVERSION	
	Value Added (a)	Value Added	% Change	Value Added (b)	% Change
	($ thousand)				
PROVINCE					
BRITISH COLUMBIA	44,115	46,729	6%	50,159	14%
ALBERTA - TOTAL	885,427	1,006,223	14%	1,116,382	26%
SASK. - TOTAL	1,346,705	1,509,101	12%	1,689,157	25%
MANITOBA - TOTAL	411,023	455,069	11%	499,798	22%
ONTARIO	387,824	440,751	14%	479,583	24%
QUEBEC	41,470	58,605	42%	67,533	63%
ATLANTIC PROVINCES	118,748	113,464	-4%	122,398	3%
CANADA - TOTAL	3,235,384	3,630,982	12%	4,024,958	24%
CANADA CASH CROPPING COSTS -- TOTAL	4,741,288	4,604,941	-3%	4,614,398	-3%
CANADA HECTARES SET-ASIDE (000'S)		2,975		2,975	
DIVERSION PAYMENT				TOTAL	$ PER HA
BRITISH COLUMBIA				3,430	172
ALBERTA				182,853	132
SASKATCHEWAN				171,124	186
MANITOBA				40,076	123
ONTARIO				38,752	236
QUEBEC				8,848	173
ATLANTIC PROVINCES				7,514	683
CANADIAN TOTAL				372,597	125

(a) Farm Value Added is equal to total production * (export price - transport costs) - cash production costs. Production of crops other than grains is also included.

(b) In this scenarion the diversion payment has been added into Farm Value Added.

Source: MacGregor, Capabilities, Complementarity and Substitutability of Alternative Models: Agriculture Canada's Experience, 1987.

as $372 million a year, $125 per ha on average (Table 5.5). This is considered an upper limit as poorer quality land not reflected in the model will be offered first and with less risk relative to growing crops farmers are expected to accept a lower return on diverted land.

The regional payment required to bid land out of production is quite variable indicating that uniform payments may prove very expensive and that it may be cheaper to focus the program entirely in the Prairies. The diversion payment will directly increase farm value added, improving it by 24 percent over the reference run, double the improvement of a non-paid compulsory diversion. However, these results do indicate that the grain sector is significantly better off even without a diversion payment and before payments from existing programs (WGSA) are accounted for. Therefore, it must be questioned whether the additional incentive of a paid diversion is required or needed. Through the existing marketing control mechanism Canada could probably institute an acreage reduction program and has used this power in the past in relation to the 1970 Lower Inventories For Tomorrow program which did not include any payment for diverted land.

5.4 Macro-Economic Effects: The Agricultural IO Model

The acreage reduction program increases the real price of grain, but reduce output. The impacts of higher grain prices on the livestock sector and on domestic demand must be taken into account. Over the five year period Realized NFI increases by $7.1 billion, almost entirely in crop receipts. Wheat exports and inventories are up by 12.1 mt while barley declines by 6.4 mt, canola by 7.4 mt and corn by 1.1 mt. In the livestock

sector, domestic disappearance is generally lower, as are exports. Domestic pork disappearance is down by 22.62 million pounds and exports by the equivalent of 621,000 head. Domestic beef consumption increases by 29 million pounds while exports decline by 200,000 head. Fluid milk consumption falls by 42.7 million litres and chicken disappearance is down by 81.5 million kilograms.

The impact of the acreage reduction program on various industries, and in total, is shown in Table 5.6. Overall the impact is positive with industrial output up by $2.5 billion over the 5 years, GDP at factor cost up by $1.9 billion and employment up by 13,000 jobs. Although the net impact is positive, the industry level impacts are varied. The Finance, Manufacturing and Wheat industries benefit the most. However, the Small Grains industry, the Accommodation and Food Service industry and the animal based industries all decrease as production and consumption of processed animal products decrease. Within agriculture the industries that improve are wheat, field crops, fruit and vegetable farms, and miscellaneous speciality farms. All other agricultural industries decrease in every category. The net impact on the agricultural sector is a decrease in industrial output of $1.4 billion, $0.4 billion in GDP and overall employment falls by 41,000 jobs.

6.0 CONCLUSIONS AND IMPLICATIONS

Three general conclusions about the proposal need to be stressed. The first is that a relatively small, limited program similar to the one analysed, has the potential to correct the current imbalance in the world's

TABLE 5.6: MACRO ECONOMY IMPACT OF COOPERATIVE ACREAGE SET-ASIDE: CUMMULATIVE IMPACT FROM 1987 TO 1991, Simulation results.

	INDUSTRIAL OUTPUT	GDP AT FACTOR COST	EMPLOYMENT
	('000 $)	('000 $)	(Jobs)
INDUSTRIES			
IMPACT OF INCREASE IN NET FARM INCOME AND AGRICULTURAL OUTPUT			
DAIRY FARMS	142,004	86,461	4,053
CATTLE FARMS	189,629	98,639	5,663
HOG FARMS	61,579	30,454	965
POULTRY FARMS	49,935	24,265	613
WHEAT FARMS	1,062,598	771,468	20,952
SMALL GRAINS FARMS	379,657	141,740	10,480
LIVESTOCK COMBINATION FARMS	65,065	35,173	1,302
FIELD CROP COMBINATION FARMS	5,374	2,468	113
FOOD PROCESSING	1,020,313	220,999	6,739
MANUFACTURING	2,176,413	653,146	20,641
TRANSPORTATION AND STORAGE	617,117	333,931	10,013
RETAIL TRADE	813,775	557,027	30,783
FINANCE, INSURANCE, REAL ESTATE	2,199,699	1,353,605	16,053
ACCOMODATION AND FOOD SERVICES	530,696	292,036	19,711
COMMUNITY, BUS., PER. SERVICES	621,480	427,154	22,024
TOTAL IMPACT OF INCREASE	12,429,375	6,111,227	206,030
IMPACT OF DECREASE IN NET FARM INCOME AND AGRICULTURAL OUTPUT AND NET IMPACT			
	NET IMPACT	NET IMPACT	NET IMPACT
DAIRY FARMS	161,503 -19,499	98,333 -11,872	4,609 -556
CATTLE FARMS	424,134 -234,505	282,728 -112,089	12,667 -7,004
HOG FARMS	165,888 -104,309	82,039 -51,585	2,600 -1,635
POULTRY FARMS	82,238 -32,303	39,962 -15,697	1,010 -397
WHEAT FARMS	610,214 452,384	443,028 328,440	12,032 8,920
SMALL GRAINS FARMS	1,817,297 -1,437,640	670,466 -536,726	50,167 -39,687
LIVESTOCK COMBINATION FARMS	112,453 -47,388	60,789 -25,616	2,250 -948
FIELD CROP COMBINATION FARMS	9,788 -4,334	4,445 -1,985	205 -92
FOOD PROCESSING	1,149,692 -129,379	186,479 34,520	5,932 807
MANUFACTURING	1,899,493 1,876,920	274,010 379,136	7,249 13,392
TRANSPORTA	607,186 9,931	330,215 3,716	10,637 176
RETAIL TRADE	460,326 353,449	315,092 241,935	21,939 16,844
FINANCE, INSURANCE, REAL ESTATE	489,398 1,790,301	258,597 1,095,008	4,461 12,392
ACCOMODATION AND FOOD SERVICES	953,307 -422,611	526,031 -233,195	35,407 -15,696
COMMUNITY, BUS., PER. SERVICES	148,683 472,005	102,266 324,000	5,120 17,704
TOTAL IMPACT OF INCREASE	9,940,159	4,230,355	192,782
NET IMPACT OF COOPERATIVE ACTION	2,489,216	1,000,872	13,256

Source: Thomassin and Andison, Complementarity and Competitiveness of Econometric, Input-Output and Programming Models: Agriculture Canada's Input-Output Model, 1987.

cereal market. Elimination of excess stocks will ease pressures on world markets to a considerable extent. The second conclusion is that only a modest adjustment is required on a multilateral basis to eliminate excess stocks. While more fundamental discussions are occurring within the MTN's with a view to eliminating all subsidies that distort trade, no such dramatic change is envisaged in this analysis. A ten percent reduction in seeded acreage is felt to represent a program within the scope of current policy in the countries involved. The third conclusion is that an ad hoc, short term program is all that is immediately required if approached on a multilateral basis. Within three years a substantial reduction in excess US stocks is possible and with current policies in the US and EC that limit production the likelihood of keeping stocks down is much better as compared to the early 1980's.

The results indicate that Canada's grain sector and economy will benefit if a cooperative acreage reduction program is implemented. Although export volume declines, this is more than offset by an increase in the value of exports. Realized Net Farm Income improves by over 50 percent in the last three years of the period analysed and government cost declined substantially. The livestock sector is negatively affected by increased grain prices, as expected, and the cost of livestock stabilization programs that offer protection against rising feed costs are higher by some $300 million over the 5 year simulation period. The impact of US grain export subsidies (the Export Enhancement Program) on depressing Canadian prices below US prices is also demonstrated.

The CRAM model demonstrated that program design is important if Canada is to meet its international commitments in reducing overall grain

production. Seeded area may have to be directly targeted rather than cropland in total and this will become more important if the amount of summerfallow increases in the coming years as farmer adjust to lower prices. If a paid diversion is employed it will cost the Government some $370 million annually, offsetting savings on grain stabilization programs over the period. Grain producers value added improves with the cooperative program by 12 percent, even without a diversion payment and before existing program benefits (mainly WGSA) are added to the estimated market return, so it is questionable whether additional incentives are required. Other factors that would need to be considered in implementing a diversion scheme would include alternative uses for land taken out of grain production and the positive, long term, societal impact of taking land highly susceptible to degradation out of production. The conservation aspects of land use may provide a very socially acceptable foundation for implementing land diversion programs in many producing countries.

The macroeconomic impacts on Canada are analysed using a static agricultural IO model. Overall, participation is beneficial to Canada with GDP at factor cost increasing by $1.9 billion and employment up by 13,000 jobs over 5 years. A worrisome factor is that, overall, agriculture looses. Based on the FARM projections used by the IO model, the wheat sector did gain, however the small grains and livestock sectors declined by more than wheat gained. From an agricultural standpoint, participation must be questioned as it is not likely that the livestock sector will support action of this nature given the negative impact projected. The effect of starting the program in 1987/88 and using 1986 acreage as the base also needs to be considered.

The US comes out as a major beneficiary of this cooperative program based on the simple uniform program rules imposed. From a farm income standpoint the US is actually slightly worse off with NFI down by 1.8 percent, on average, as improved market prices for grain simply offset government support payments and the livestock sector suffers from higher domestic prices for feed grains. The US government does benefit to the extent of some $US 3 billion a year and this is not insignificant given US budgetary deficits. The world volume of grain trade declined slightly, but US grain acreage, production, exports, and market share increase as compared to the baseline as their excess stocks are eliminated through multilateral rather than unilateral action.

Besides production and trade volumes, very little information on the impact of this program on the other exporters is available. Significant reductions in export levels for a debt ridden country such as Argentina may not be viable, especially with indications that its grain export earnings would remain virtually unchanged. Preliminary calculations indicate that Australia's export earnings would increase as increasing prices more then offsets the volume reduction. That the EC would impose a programme to the extent it becomes a net importer of coarse grains is also questionable. It would be interesting to run this same scenario through comprehensive sector models for Australia, Argentina and the EC to determine if they have an incentive for participating in some form of cooperative supply control program. Further analysis of the EC situation would also have to take into account the linkages between the cereal and cereal substitute markets and the impact on the oilseed meal market that have not been dealt with in this analysis.

In the current GATT round fundamental and comprehensive change is being sought in terms of reducing the impact of trade distorting policies, improving market access and developing effective rules to govern trade in agricultural products. How individual countries redistribute wealth within their borders to support their agricultural sectors is not the issue in these MTN's. It is the impact domestic programs have on international trade that is the concern. Associated attempts to relieve market pressures in the short term must not be viewed as a substitute for these more fundamental changes being sought in the MTN's. Any short term, commodity specific program will have to be integrated into the overall MTN process, complementing the GATT negotiations. However, a role is seen for such programs by most major grain exporters. Even if early success is achieved in the MTN's, this will do little to relieve the current market pressures.

Most countries will continue to protect or support their domestic agricultural sectors, to some degree, regardless of the outcome of the current Multilateral Trade Negotiations. The inherent instability faced by agriculture is often cited to justify government intervention, instability which is magnified as governments unilaterally try to deal with the effect of the supply/demand imbalance through programs such as export subsidies, often in direct response to programs of other countries. Past policies that contribute to the existing situation provide some insight, but very little is gained from looking backward to assess blame. Even trade theory accepts the dynamic nature of the trade relationship knowing that comparative advantage and production possibility frontiers, the basis for trade, are not static, especially when technological change is rapid. Distortions do make determination of comparative advantage quite difficult and it may be that production possibility frontiers are quite similar in many developed

countries.

Regardless, these first round results are judged to be reasonable in demonstrating the direction and magnitude of change that would result if a cooperative acreage reduction program is negotiated. The impact of the program on the US and Canada are analysed in some detail and both benefit from higher world prices, but within each country some sectors are made worse off. How the analysis is carried out may be of more interest. Four existing models are used to provide information that is critical if informed decisions are to be made. Several problems have been highlighted and it would have been preferable if several iterations could have been made between the various models to correct for inconsistencies. Exporters in forums such as the Cairns Group are searching for mutually beneficial ways to alleviate current market distortions and pressures. International cooperation in exchanging information and jointly assessing proposals may assist the MTN negotiators in reaching a multilateral package of reforms.

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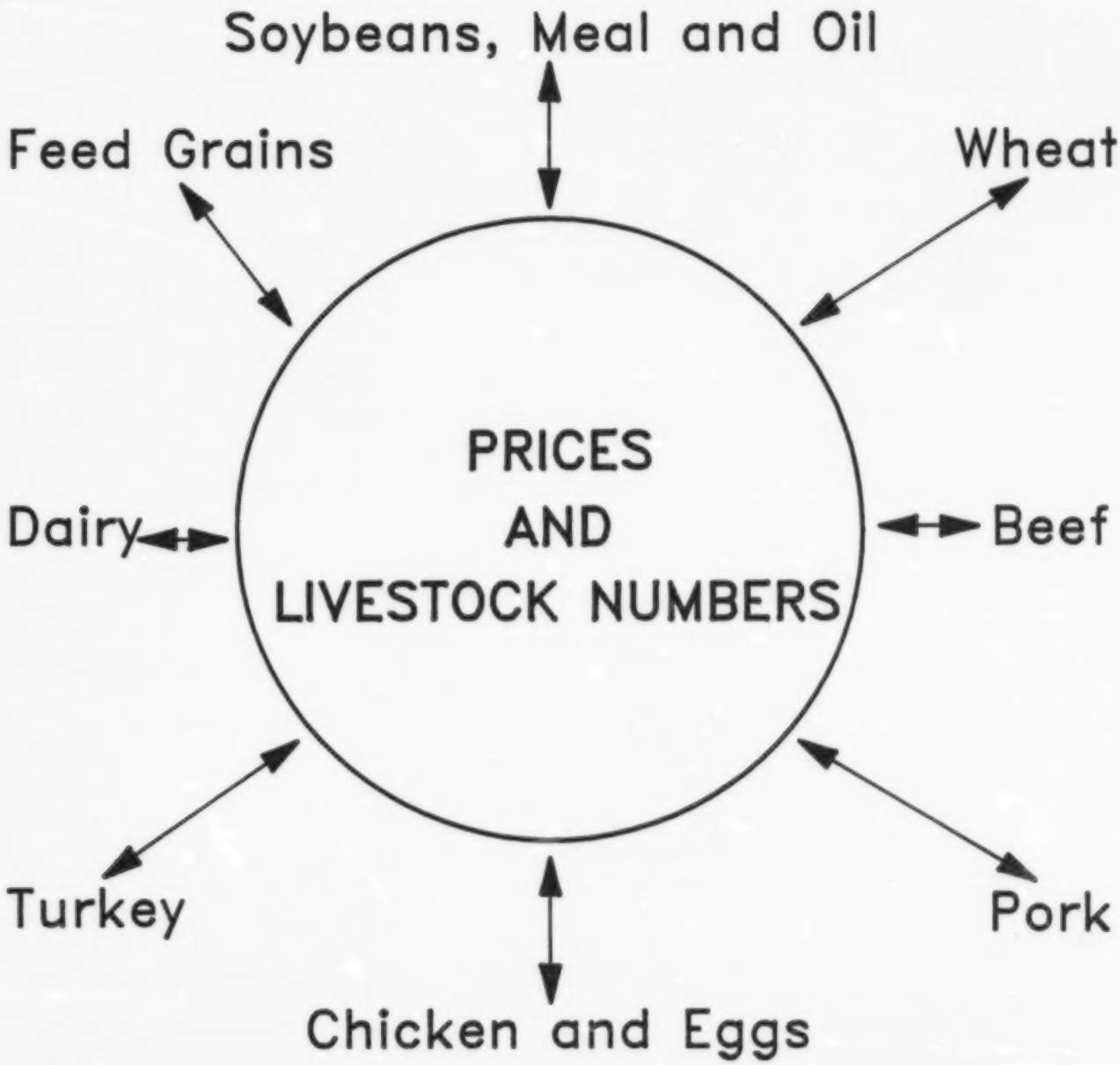
APPENDIXES

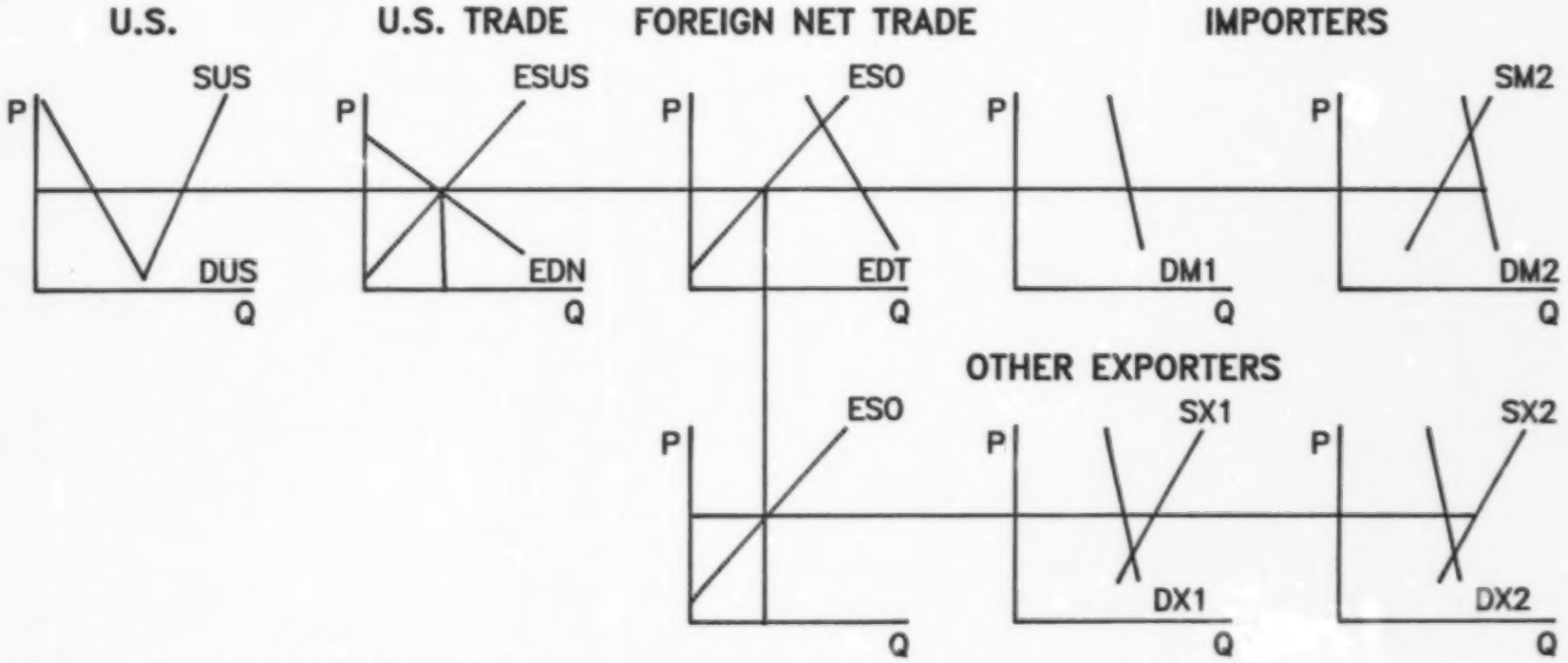
Figure A1
U.S. AGRICULTURAL INDUSTRY
SIMULTANEOUS SYSTEM



Source: Food and Agriculture Policy Research Institute

Figure A2

SUPPLY AND DEMAND MODEL FOR GRAIN TRADE

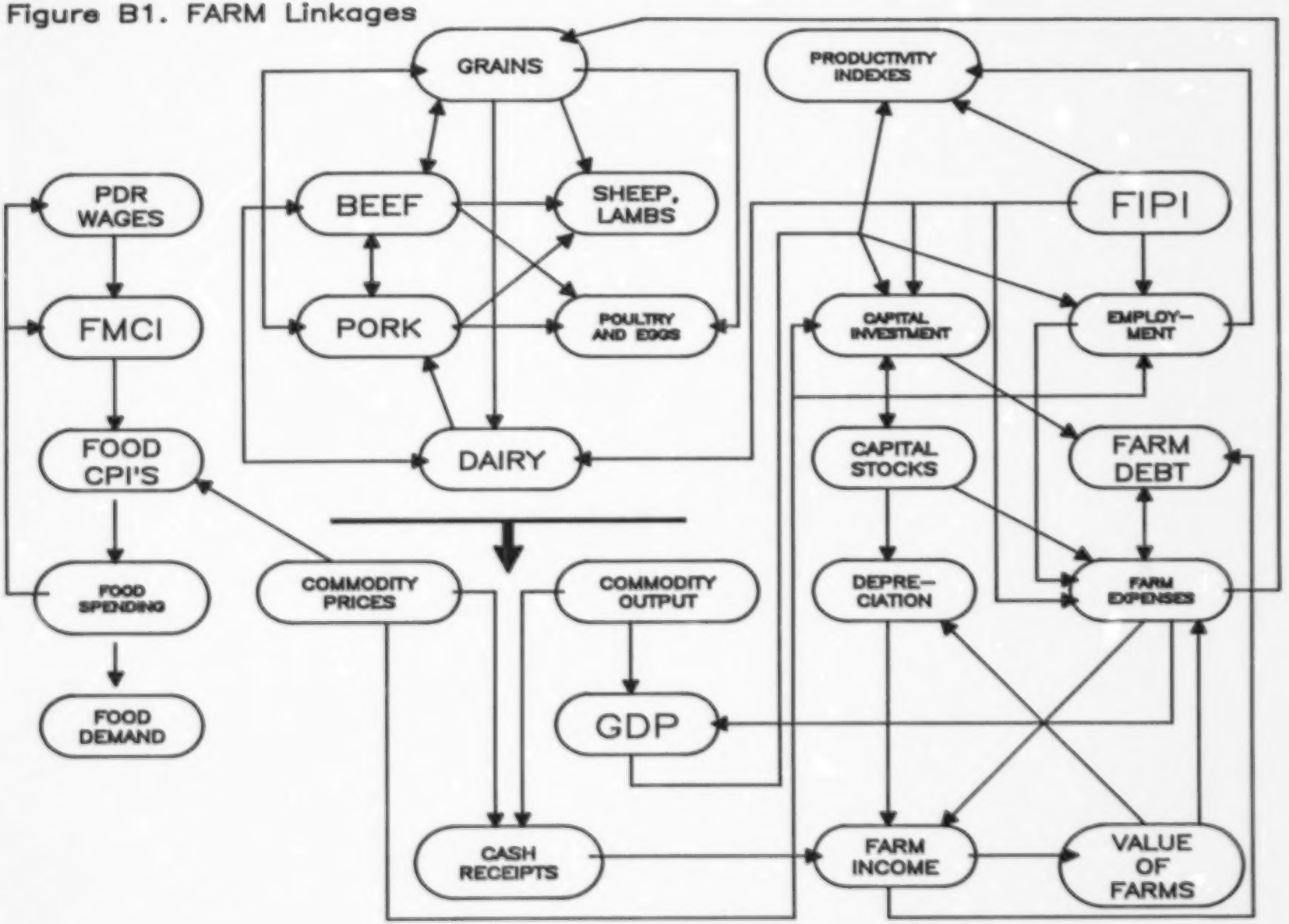


TRADE EQUILIBRIUM

- Net demands of importers (EDT)
- Net supplies of exporters (ESO)
- Excess demand for U.S. markets (EDN)

Source: Food and Agriculture Policy Research Institute (undated)

Figure B1. FARM Linkages



SOURCE: JOHANNSEN, THE FOOD AND AGRICULTURE REGIONAL MODEL (FARM), OTTAWA 1986

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No. 3 Exporter Cooperation in the World Grain Trade. R.J. MacGregor. February 1988.

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